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The supply function of olive oil: a case study of Italy

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Abstract

The aim of this work is to estimate the equation of supply for olive oil in Italy. We use a series of data from 1983 to 2007, from FAOSTAT, EUROSTAT, ISTAT and ISMEA. We also want to understand what variables influence the supply of olive oil, using the program OXMETRICS.
For the supply equation we will try to understand if the classical variables used for the analysis of supply affect or not the amount of olive oil on the market, or if other variables are able to explain the choices of production.

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Keywords: Olive oil; supply; olive oil production; Italy; supply function.

1. Introduction

Olive oil is at the base of the Mediterranean diet since the past. In fact 80% of the production of olive oil is concentrated in the European Union. The major producers are: Spain, Italy and Greece. In these countries olive oil represents not only a resource for rural economics, but it is also an important part of the cultural and environmental heritage. In some regions of these countries, olive oil is the most important agricultural activity, in terms of employment and percentage of cultivated area. Other producers, outside the European Union, are also facing the Mediterranean, namely Tunisia, Turkey, Syria and Morocco. Minority units are produced in the American continent, Australia and Japan.

Spain is the country with the highest number of olive trees (more than 300 million), and is nowadays the

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world's leading olive and olive oil producer and exporter. Italy is the second European producer; two-thirds of the production is represented by extra-virgin olive oil with 40 PDO and PGI (Protected Designation of Origin and Protected Geographical Indication), widespread over the whole national territory. Greece devotes 60% of its cultivated land to olive growing. It is the world's top producer of black olives and has more varieties of olives than any other country.

World Production of Virgin Olive Oil
(thousand tonnes)
2012

World	**3320**
Spain	1383
Italy	572
Greece	350
Turkey	206
Syria	200
Tunisia	192
Morocco	120

Source: data processing FAO-STAT

The traditional consumer countries coincide with the producing countries of the Mediterranean basin. The culture of olive oil, thanks to a thousand factors like promotional campaigns, is spreading in areas of the world that are not traditionally consumers. There are, in fact, countries that over time saw coming within their borders conspicuous colonies of emigrant producing countries, and those that only recently have moved closer to the Mediterranean diet and knowledge of the health qualities of olive oil.

For example, the United States, more so than others has a positive trend in world consumption. In ten years, its consumption has increased from 170 to 277 thousand tons, remaining the largest market among non-traditional consumers, after Italy. Benefitting from the increased US demand in 2011, Spain remains in first place as supplier, before Italy and Greece. In the near future, manufacturers will aim for China, a difficult market, but a potentially interesting one. In fact, China is a non- traditional market of olive oil, and this product could represent a luxury good for the Chinese consumers.

Despite the global economics- financial crisis, the international trade in olive oil seems to be in good health.

Major exporters of olive oil
(thousand tonnes- Standardized data)
2009

World	**1476**
Spain	718
Italy	325

Tunisia	152
Greece	107
Portugal	45
Morocco	45
Turkey	31
Argentina	18
USA	6
France	5
Germany	4
Chile	2

Source: data processing FAO-STAT

Major importers of olive oil
(thousand tonnes- Standardized data)
2009

World	**1586**
Italy	494
USA	277
France	114
Portugal	71
Spain	71
UK	59
Germany	55
Brazil	47
Japan	35
Canada	33
Australia	31

Source: data processing FAO-STAT

The majority of countries act, at the same time, both as exporters and importers of olive oil; however, some come to the point that they are clearly doing arbitrage activity; that is to say that in these countries, operators find it advantageous to re-export the imported olive oil, after handling (activities that may include mixing with other oils and bottling). Among the major exporters who at the same time import large amounts of imported olive oil are Italy, second as exporter and first as importer, based on the data of FAO and, to a lesser extent, Portugal.

2. Materials and methods

For this project we will use the software Oxmetrics to estimate the equations of supply for Italian olive oil and finally to study the possible causes of the results.
The variables used to estimate the supply of olive oil:

Prod	Production of olive oil expressed in tones (FAO)
Prodolive	Production of olive in tones (FAO)
Area	Area of permanent crops in Italy (1000 Ha) (FAO)
Proil	International price of extra virgin olive oil (index mundi)
Prharv	Price harvester and thresher Import Value (1000 US$)
Stockplant	Plantation stock crops Net Capital Stock (constant 2005 prices) (USD million) (FAO)
Prcrudeoil	International crude oil price (index mundi) (FAO)
Prolive oil	Producer Price Olives (USD/tonne) (USD) (FAO)

Using the double log transformation, we estimate the equation of supply:

① $\mathbf{Log(Y) = \beta 0 + \beta 1 * Log(x1) + \beta 2 * Log(x2) + \beta 3 * Log(xn) + \varepsilon 1}$

As will be seen later, some of these variables will be eliminated because they cannot explain the equations of supply of Italian olive oil.

3. Results and discussion:

First of all, we start with the analysis of the variables that can explain the equations of the olive oil supply in Italy. The estimation sample is for the years 1983 – 2007, for taking into account all possible shocks in the olive oil market, and to understand the change in the value, and the possible causes.
After several attempts with the data in raw form, we decided to switch to the analysis of variables expressed in logarithms.
An initial analysis reveals that not all the variables affect the supply of olive oil, so we decided to eliminate them. We deleted the variables: price of olive, price of harvester and stock of the plant. We found that the price of crude oil doesn't affect the supply of olive oil. Several reasons can explain this phenomenon. The price of the olives, and of the machines are not able to influence the supply of olive oil, because Italian firms are small (the average firm is about 3 ha) and family-run. Also in many regions of Italy, farmers continue to harvest the olives by using traditional methods to preserve the flavor of the oil and respect the traditions of the

territory. We must consider that the income of farmers is supported by the European Community through incentives provided by CAP (Common Agricultural Policy), which protect small farms.
Comparing the trends related to the production of olive oil with the other variables including dummy variables to take into account the shocks of the market, and using lag for seasonality, the results do not change. Seasonality refers to the biological cycle of the plant, which in the case of the olive tree, is about two years.
For these reasons we decided to use only the variables that show a p-value less than the critical value of 0.05 that gives a high R^2. In this case it is equal to **0.995934** (very high).

- Modeling **Prod** by OLS

	Constant	**Std Error**	**t- value**	**t-prob**	**Part.R^2**
Constant	-3.73279	0.6587	-5.67	0.0000	0.6046
Prodolive	1.03768	0.01510	68.7	0.0000	0.9956
Proil	0.0665837	0.03100	2.15	0.0436	0.1801
Area	0.739673	0.1531	4.83	0.0001	0.5265

sigma	0.0101353	RSS	0.00215721845
R^2	**0.995934**	F(3,21) =	1714 [0.000]**
Adj.R^2	**0.995353**	log-likelihood	81.4992
no. of observations	25	no. of parameters	4
mean(Prod)	5.75733	se(Prod)	0.148675

Also analyzing the F statistic, there is a significant value.

Regarding the production of olive oil, as evidenced by Retzitis and Sassi (2013), the estimated periodicity of a cycle for perennial plants is about 6 years. This is confirmed from the regression analysis of this study which shows a cycle of 5 years. In fact, to have significant data production the date with 5 lags must be used. Also we have to consider that in the last 10 years the choice and seed of olive tree has increased significantly, due to the financing of the Common Agricultural Policy of the European Union. The prices of substitutes do not give meaningful values, so it was decided to eliminate them from the analysis. Most likely this is because these prices are expressed at the international level and do not take into account the specificities of the product.

For calculating the elasticity of supply, for the logarithmic equation, we can consider the coefficient α. In this case, the elasticity of supply with respect to the price is $0.07 < 1$ so it is inelastic, as expected. If the price of olive oil increases by 10%, the quantity supplied increases only by 0.07 €. It is technically and economically possible to reduce the supply of perennials after planting. Usually Italian firms for the production of olive oil are small and do not have the necessary capital to invest in long-term improvements and introduce new technologies for the olive harvest.

4. Conclusion

The production of olive oil, one of the most important resources in the economy of Italy and the Mediterranean basin, is a complex reality. This work, through the analysis of the variables that influence supply and demand, has shown that the classical variables usually used in the agricultural sector do not reveal significance in the case of olive oil. In the future, it will be interesting to extend this work, with the support of

other variables. For the analysis of supply, it will be important to see the impact of European policies. As shown, in fact, the producers would not be able to produce without these subsidies, and the next reform in agricultural policies must take account of this. This fact is aggravated by the inelasticity of supply, as mentioned earlier due to a lack of business investment, which does not allow farmers to enlarge the size of the company and buy modern equipment for harvesting olives. If the market dynamics show in recent years (since 2007) a slight price recovery origin of the product, the future is not so rosy, because of competition from incomers like Spain, Tunisia and Greece (Bernini Cari, Sassi, 2008), able to produce at lower costs. It is then a case of directing the Italian olive oil towards quality.
The next step of this work will analyze the factors that influence the demand for Italian olive oil and the strategies that Italian producers will have to face in order to remain competitive in the international market.

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